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The Game Inspector: a case study in gameplay preservation

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Abstract : This paper presents the development of the Game Inspector at the National Videogame Arcade (United Kingdom) and the implementation of this device through a case study of *Super Mario Bros.* This development has been influenced by previous research and ongoing debates about the preservation of the playable experience. Considering the accessibility issues emerging from the difficulty and complexity of video games, I explain the benefits of annotated audiovisual documentation in the context of museum exhibitions.

Keywords : Video game preservation, Video game exhibition, *Super Mario Bros.*, National Videogame Arcade

On 28 March 2015, the UK's National Videogame Arcade (NVA) opened its doors to the public. Located in the centre of Nottingham, it is a 'cultural centre for video games…equal parts art gallery, museum exhibit and educational centre' (Parkin 2015a). Alongside myriad consoles, computers and Coin-Op cabinets, objects and artefacts specifically collected and donated by

members of the public and industry veterans alike, a new category of interpretative exhibit was unveiled: The Game Inspector. Bespoke devices designed and fabricated by the NVA's curatorial and engineering teams, the Game Inspectors allow visitors to explore a variety of videogames, investigating their level designs, object and enemy placement, discovering multiple routes and exits, and revealing hidden items, power-ups, secret rooms and even secret stages - with one important twist. All of this discovery and investigation is achieved without actually playing the games themselves. Instead, the Game Inspectors make use of annotated maps of specific levels overlaid with contextual information and numerous video captures that demonstrate and unpack different gameplay techniques, design elements, and glitches. The Game Inspectors seek to account for the ludic potential of a videogame by demonstrating it at play in a host of different ways all of which can be accessed through an interface that allows scrutiny and movement through the game's space which is littered with the palimpsests of previous play and/or its design. Figures 1 and 2 show a Game Inspector map at different levels of zoom with the icons that trigger specific annotated gameplay videos visible in Figure 3. This is a playful interface, for sure, but an exhibit in which the play has already been performed.

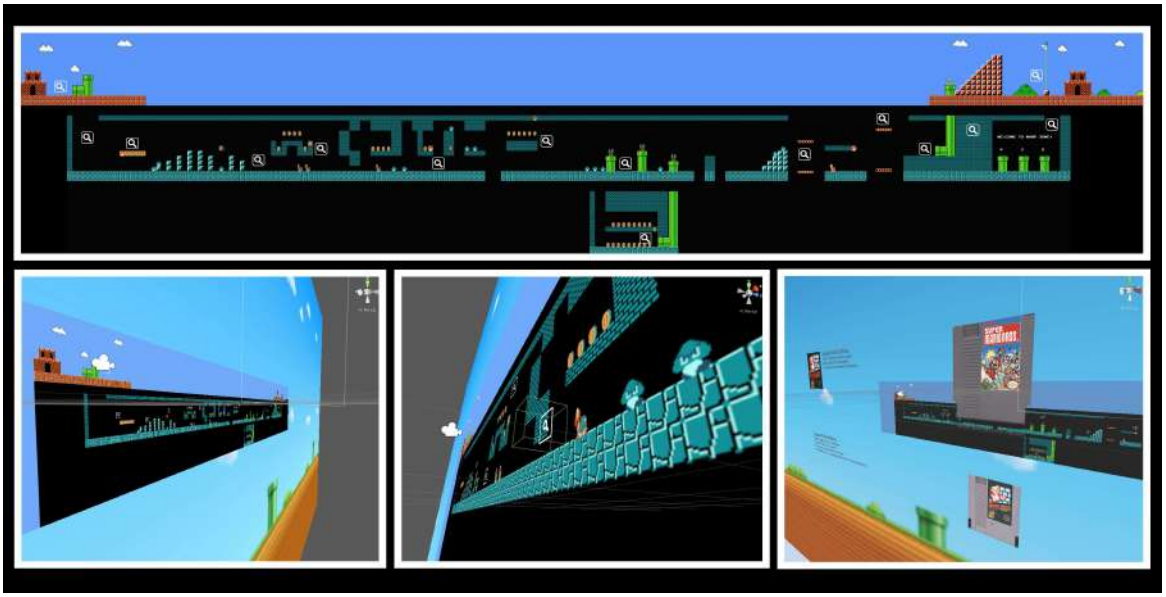

Figure 1. *Super Mario Bros.* (Nintendo, 1985) World 1-2
Game Inspector annotated game map and Unity development

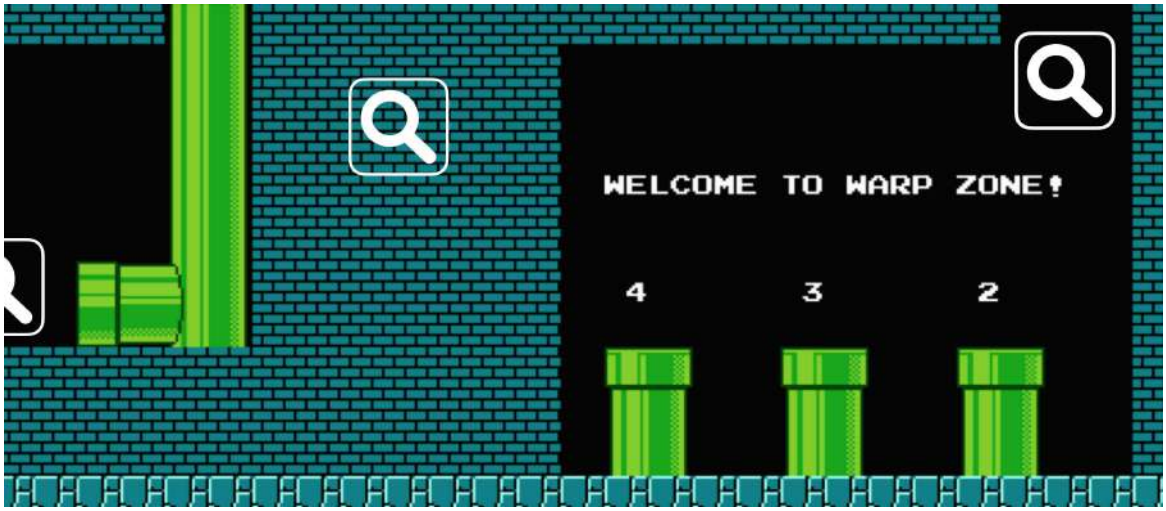

Figure 2. *Super Mario Bros.* (Nintendo, 1985) World 1-2
Game Inspector zoom-in on Warp Zone showing av asset trigger icons

As a member of the curatorial team that developed the Game Inspectors[1], I wish to offer some insight into the ethos, motivation and intentions behind the *Sonic the Hedgehog* (hereafter *Sonic1*, Sega 1991) and *Super Mario Bros.* (hereafter *SMB1*, Nintendo 1985) exhibits with a specific focus on the latter. This will involve considering how the exhibits are shaped by the NVA's mission for inclusivity, the gallery context for encountering the exhibits, and some of the distinctive and challenging qualities that videogames and gameplay present. Importantly, the Inspectors are exercises in both practical exhibition and user experience design and are part of an ongoing research project considering the challenges of preserving, interpreting and engaging with videogames as cultural heritage and museum objects.

As such, this article examines the ways in which the Game Inspectors draw on research into the role and function of play in videogame preservation and exhibition thereby functioning as tangible embodiments of what I have elsewhere termed 'gameplay preservation' (Newman 2012a). In putting these ideas into practice, the Game Inspectors raise important questions about how player agency, the contingency of play, and the interactions between player, code and system, are communicated. To be presented with recorded gameplay might appear to fulfil the criterion of accessibility by unlocking aspects of the game, its design and affordances unavailable to all but the expert player with the requisite a priori knowledge and skills. However, in the absence of a first-hand experience of that gameplay and the contingencies of

[1] The engineering, research and development team at the NVA included Iain Simons, Alex Roberts, Jason Tomlinson and Allen Coombes.

play, the challenge becomes one of communicating the extent of the control and influence the original player did have when they performed those moments of gameplay. In this way, we note the importance of the game research and curator as interpreter and a potentially new site for the presentation of interpretative insight into game design and gameplay.

Ultimately, the Game Inspectors may be seen as attempts to develop not only approaches to game interpretation and analysis but also to game citation. While this cannot compete with the scope of the work on metadata, controlled vocabulary and discovery undertaken by Eric Kaltman and colleagues on the GAMECIP project[2], I believe the focus on spectatorship and video capture along with the use of the map as a means of organising these materials and anchoring them to the game's structure and material design might make a contribution to the discussion of the citation of moments, sequences and examples of gameplay *within* games.

Videogames in the gallery

As Swalwell (2017) has noted, in recent years, a growing number of museums, galleries and cultural institutions across the world have responded to the cultural, political, economic and social significance of videogames by developing collections and staging exhibitions and events. Organisations such as ICHEG are dedicated to documenting the histories of gaming in both analogue and digital forms charting fascinating lines of lineage between mechanical, board and digital games. Along with Berlin's Computerspielemuseum and more recently-opened entities such as the Videogame History Museum in Frisco, Texas, such projects contribute to the documentation, preservation and archiving of the history of the videogame industry, its output and development practices. Exhibitions such as the Barbican's 'Game On/Game On 2.0' and the Australian Centre for the Moving Image's 'Game Masters' have toured extensively demonstrating the global audience for game history and, perhaps not always intentionally, sparking discussions about authenticity, the original experience and the uses of emulation (see Swalwell 2017: 222, for instance, and also Aravani (2016) on the Museum of London's approach to exhibiting the ZX Spectrum).

In addition, and in keeping with their broader missions, institutions such as MoMA and the Smithsonian American Art Museum place videogames in a different context and seek to bring

[2] The Game Citation and Metadata Project (GAMECIP) is an IMLS-funded investigation of metadata needs and citation practices surrounding computer games in institutional collections. It is a joint initiative between UC Santa Cruz Library, UC Santa Cruz Computer Science, and Stanford University Library. https://gamecip.soe.ucsc.edu/

them to somewhat different audiences by zooming in on gaming as an artistic medium and reactivating the question of games as art (see Clarke and Mitchell 2007). Indeed, exhibitions such as MoMA's actively re/decontextualise gameplay, hardware and software by setting controllers and generic displays into the otherwise white walls of the gallery space in order to focus on interaction design and code. As curator Paola Antonelli noted in a TED Talk on the experience of staging the exhibition. "We don't want to show the videogames with the paraphernalia – no arcade nostalgia." It is clear, then, that this decontextualisation was an explicit curatorial and exhibition design intention and that the conditions and contexts of the gallery as cultural space took precedence over any 'original experience' and was invoked to provide an unequivocally authoritative interpretative frame. The very act of putting videogames into the gallery appears to have constituted at least part of the (putatively provocative) objective of the project.

Reviewing the Smithsonian's 'The Art of Video Games' exhibition that ran in 2012, Kohler (2012) notes its success in 'showcasing games as creative works as opposed to technological marvels.' The focus on games and/as art and the placing of these works of popular culture in gallery spaces is certainly important in paving the way for the work at the NVA and helped us map a distinctive route. Informing our approach and the specifics of our exhibition design is the desire to drill down into the detail of gameplay in order to explore the minutiae of level design and players interactions with rules, systems and code. To some extent, we sought to pick up on Kohler's closing comments on 'The Art of Video Games' which noted that,

> I hope that The Art of Video Games is not where the Smithsonian American Art Museum stops, but instead serves as an entry point for even narrower, more narrative-driven exhibitions that continue to educate about games. (Kohler 2012)

Of course, none of this runs counter to an interest in exploring videogames as a form of contemporary creative expression. Indeed, elsewhere in the NVA our attention falls squarely on investigating the practices of production of both visual and sonic arts by developers and fans alike. However, alongside this, an overriding challenge we set ourselves in developing the NVA's strategies was to develop a set of interpretative tools that allowed visitors to access parts of games they might not ordinarily get to see; and, crucially, to offer insight into how sequences of gameplay might differently represent the intentions of designers, the creative tactics and strategies of players, and the operation and malfunctioning of code.

In developing the Game Inspectors, we saw as key this detailed concern for communicating the

intricacies of gameplay and its operation at a systemic level. Certainly, this is one means by which we distinguish the Game Inspector project from other, perhaps more disintegrated, investigations that sometimes focus on the visual art (or music) of videogames by abstracting these elements and placing them under a lens. What is particularly distinctive and challenging about the Game Inspector project, however, is the decision to eschew playability and instead create an exhibit wholly based around navigating an interconnected web of captured and annotated performances of games being played.

To be clear, this was not a position arrived at after surrender or resignation to the impossibility of retaining long-term playability nor does it underestimate the importance of performance and playability. Of course, there are, without doubt, practical considerations that must be taken into consideration in seeking to make available hardware and software whether in its original form or under emulation. Certainly, as Swalwell notes, these fragilities mean that, 'the ways in which games are exhibited typically does not – and for important reasons often cannot – be held to the standard of the 'original experience'. (2017: 222).

The brute fact is that controllers break, displays burn out and cartridge connections corrode. The vulnerability and fragility of gaming hardware and software has been demonstrated in studies such as the Preserving Virtual Worlds Report (McDonough 2010) and my own book Best Before (Newman 2012a) among others. The security of data stored on deteriorating physical media, the lack of long-term availability of servers required for running or activating online games, and even business and retail practices that render obsolete superseded platforms, all contribute to a situation in which games disappear and become harder and even impossible to access and play. It is for these reasons that, for exhibition purposes, what Swalwell calls 'Frankenstein' devices combining elements of original hardware with more durable computers running emulators, are commonplace (though see Aravani 2016).

While these apparent impediments might present tempting reasons to seek to sidestep the issue of playability, the centrality of captured gameplay footage in the Game Inspector arises from an altogether more positive thought experiment. In the concluding section of Best Before I propose an approach to game preservation based around 'letting videogames die'. However, far from denigrating playability, in using this deliberately provocative phrase I seek to recognise the importance of (game)play as a configurative, transformative and constitutive act as well as one that is always already socially and culturally situated. The crux of the thought experiment in Best Before is to consider that play is not the outcome of game preservation but as its object. It

is this position that insight into play might not come through the future availability of first-hand playability but through the observation of carefully presented and curated sequences of somebody else's gameplay, that underpins the research and development of the Game Inspectors.

Game(play) preservation

The suggestion that playability might not unquestionably constitute the outcome of game preservation seems a perverse, and perhaps even heretical one at first. Surely, if there is one thing we know about videogames, whether we encounter them as players or scholars or both, it is that they are defined by their ability to be played and played with. It is hardly surprising, then, that so much work on game preservation strategies has been based around the maintenance of original hardware and software, the migration of data from vulnerable to modern storage formats, and the development of emulated or virtualised environments for replay. As Monnens (2009: 6) notes, emulation and data migration might be seen as 'the only viable techniques of long-term preservation'.

Space here does not permit a full discussion of the strengths and limitations of migration, virtualisation and emulation strategies or the work related to specific platforms (see byuu 2011 on the development of Nintendo console emulation; and McDonough et al (2010) and Altice's (2015) reviews and commentaries) though I must assuredly concur with Serbicki's (2016) succinct summary that 'emulation is awesome!' However, it behooves us to consider why it is that we feel that playability is so important that retaining it remains so central to visions of what game preservation should be.

Regardless of whether we are considering emulation or the original hardware (see Lowood 2004), 'videogames must be played to be understood' is a mantra that, from the earliest days, was used to demonstrate the need for a distinctive discipline of game studies with its own techniques, methods and analytical frames. Certainly, this is a position I have espoused in my work and it continues to inform my position today. And so, with videogames' playability so foundational that it near-axiomatically eliminates the possibility of deploying analytical techniques imported from non-interactive media studies, what possible justification could there be for proposing an approach to videogame preservation that does not allow the game to be played?

One resolution to this apparent contradiction relies on adopting a perspective on play that describes a variety of related but significantly different practices and performances that are contingent on the differential motivations of players, as well as their skill and knowledge. Play may be articulated in terms of the 'completion' of games in the fastest possible time, the acquisition of the highest score, or by tackling the challenges in a 'pacifist' mode, dispatching only those enemies that actually bar progress and cannot be avoided. Players may seek to use as few additional capabilities or weapons as possible or may be driven by a desire to acquire every last item of inventory available, even those that are tangential. Play may involve exploring as much or, indeed, as little of the gameworld as possible by engaging in 'complete' or 'low percent' routes to completion. As such, while some players may never complete a game like *SMB1*, others are able to finish the job in less than five minutes (at time of writing, speedrun.com darbian's late 2016 *SMB1* time 4m 56s 878ms is the speediest completion).

This notion of play foregrounds its complexity, multiplicity and complicity in constituting the game'. As a multifaceted, configurative process guided by different intentions and with different objectives and outcomes, quite simply there is no singular videogame 'play'. Rather, games are subjected to and support a series of possible 'playings' - or perhaps '(re)playings' that are expert, inexpert, self-consciously exploratory, resistant, intended for demonstration, broadcast, competitive success, financial gain… Sometimes, these playings are consistent with design intentions and are anticipated by a game's makers and sometimes they are emergent and exploit revealed affordances and inconsistencies in rules or bugs in code that are most definitely unintended. Their status as unintentional bugs is confirmed as they are patched and rendered inaccessible in subsequent releases as is the case with both *Sonic1*, *SMB1*, and even the more recent *Super Mario Maker*, for instance (see Newman 2012b, 2016b, 2017).

In addition to wishing to put into practice and test the thought experiment played out in *Best Before*, the development of the Game Inspector is informed by two other overarching principles that, in some senses, similarly cut against the grain of popular thinking on videogames. Firstly, we proceed from an understanding that videogames are hard - and while this degree of difficulty might in some cases constitute the challenge or even the pleasure of the game, for our purposes it could be utterly injurious to access. Second, videogames often set out to conceal much of their complexity making it manifest, if ever, only on subsequent (re)playings.

Videogames are hard

For those well-versed in gameplay, it is sometimes difficult to remember that the linkage between direction pad and character movement, the steering of a jump in mid-air to fine-tune the landing point, or the use of that self-same jump to evade, attack and climb, are gameplay conventions consolidated over years of design and play. Moreover, they are no more obvious or readily deducible to the non-acolyte or new player than the convention of inputting a quarter-stick-rotation-plus-punch-button to loose off a fireball in a fighting game, or that the in-game death of an avatar might be but a temporary setback rather than a definitive ending. Of course, for adept players, scholars and researchers, part of the reason for forgetting that such knowledge is acquired, and how, might be a function of (over) familiarity with games and gameplay. Additionally, there is a strong discursive tradition in game scholarship and development practice that has lauded, and perhaps overstated, the extent to which videogames are accessible learning environments that teach their players the extent of their ludic potential through masterful design.

In relation to Super Mario Bros., for instance, much has been made of designers Miyamoto and Tezuka's 'player-centric' (after Fullerton 2008) approach to design. Their use of space, positioning of scenery elements and movement of enemies (see McMillen and Refenes 2011; Gifford 2010), and the parallels with kishōtenketsu, the four-part structure of Chinese poetry and Japanese comics that sees the introduction, development, twisting and resolution of a concept (see Nutt 2012) have all been extensively analysed. One outcome of these analysis is that is almost universally agreed by commentators that within the opening few seconds/screens of *SMB1,* World 1-1's design effectively forces the player into discovering some of the fundamental mechanics and gameplay opportunities that underpin the entire game (see Iwata Asks (n.d.); Eurogamer 2015; Emmons 2014). Certainly, it is not my intention to gainsay such analyses, but rather to draw attention to the fact that, despite these efforts, it remains no small achievement to complete an entire course. And, let us not forget that there are (at least) 31 more waiting in that game alone when World 1-1 is finished.

Of course, 'finished' is a problematic word to use in relation to videogames as the Jump! introductory guide notes. Is *SMB1* 'finished' when the flagpole at World 8-4 is reached? Or when darbian's '4m 56s 878ms' speedrun time is beaten? Should every coin be collected? Or every course traversed (which is impossible if we are to speed run as it is necessary to use shortcuts that circumvent many courses)? And how much progress might we reasonably expect

an expert player to make with the stock number of 'lives', or a new player encountering the game for the first time and learning its controls, logic and rules? Given that new glitches and speedrun times are being uncovered and set after 30 years of re-play, we must conclude that *SMB1* has still yet to reveal the full extent of its ludic potential.

A conceptual starting point for the development of the Game Inspectors was that the difficulty of videogames was a key impediment towards the NVA's desired mission of inclusivity. As the *Jump! Special Exhibition Guide* (NVA 2015) explains,

> We love videogames, but sometimes they can be pretty challenging. With really tough games, it can take a fair bit of skill just to get to the end of a level, let alone complete the whole game. And what do we mean by 'complete' a game anyway? There are usually many different routes through the levels, not to mention hidden rooms and secret power-ups. You might finish the game really quickly - but miss all the best bits. (NVA 2015)

As this introductory text suggests, some games are self-consciously designed to challenge even the most expert and experienced of players. Games such as those in FromSoftware's *Souls* series (2009-present) or the amateur 'Kaizo Mario' designs that eschew Nintendo's design principles in favour of unfairness and even abusiveness in Wilson and Sicart's terms (2010) are cases in point (see also Newman 2016b). In fact, even Nintendo's own *Super Mario Bros. 2* increases the difficulty levels far beyond that evident in its much-vaunted predecessor. Indeed, such was the extremity of the challenge that this version of *Super Mario Bros. 2* initially went unreleased outside Japan and was replaced with an alternative, and putatively 'easier' title in the form of a Mario-themed version of *Doki Doki Panic*. A console generation later, the Japanese *Super Mario Bros. 2* was eventually 'recovered' in 1993's Super Nintendo Entertainment System collection *Super Mario All Stars* where it was rebadged as *The Lost Levels* while the international *Super Mario Bros. 2* saw a Japanese release as *Super Mario Bros USA* (see Ryan 2015). And the pattern continues with titles such as *Super Mario Galaxy* (2007) offering both accessible design features such as the equivalent of autocompleting gameplay to alleviate the stuck player alongside additional expert speedrunning challenges. Similarly, the Wii U title *Super Luigi Bros. U* (2013) adds markedly greater gameplay challenges to its sibling *Super Mario Bros. U* (2012), for instance.

But while these games wear the extremity of their challenge on their sleeves, to focus only on such explicitly hard titles is to miss the larger point which is that *all* games are hard. All require at least some degree of skill in execution, some knowledge of the operation of the interface and

of the connection between physical controls and on-screen activity. And, as they develop and refer to one another over time, they increasingly rely on a priori knowledge gleaned from other games. None of this is surprising or revelatory, of course. These qualities, after all, constitute much of what is prized about videogames and gameplay. Through the production and consumption of virtual spaces comes the possibility of discovery. And through the acquisition, invention and deployment of techniques, tactics and strategies comes the possibility of mastery. However, as Juul (2013) and others have noted, the backdrop to all of this is the very real possibility - indeed, the inevitability - of failure. Of confusion and frustration. Of death. Videogames are hard.

Videogames are complex

Of course, the difficulties presented by videogames reach further than the execution of techniques or knowledge of interfaces and it is essential to recognise the impact of the tendency towards deliberate or incidental obfuscation in design. The presence of secrets, hidden routes, conditional or procedurally-generated events renders videogames as dynamic and mutable, but often leaves them extraordinarily bad at revealing the ways they are constructed or how their lauded experiences, spaces and structures actually operate. Indeed, design often deliberately obfuscates, with so-called 'Easter Eggs' so well-hidden and necessitating such tortuously complex solutions that they it may be several decades before they are uncovered (Koebler 2016). In *SMB1*, power-ups lurk inside blocks and are only revealed once headbutted from below, while secret rooms full of collectible coins (so-called 'Coin Palaces') sit at the end of (some of) the trademark green pipework rewarding the inquisitive player. As Ryan notes,

> ...so many hidden coins and power-ups, so many enemies and dangers, so many secrets! This wasn't a simulation; it was a world to get lost in, as replayable as a favourite book or movie or album ... Everyone played it as [world champion videogame player] Billy Mitchell did, trying to wring the computer chip of every last secret (Ryan 2012: 75)

These secrets might make *SMB1* fertile ground for superplayers and contribute to the longevity and replayability of the game, but importantly they also demonstrate that the game cannot be revealed in a single playthrough even by the most adept players. This is not simply because there are so many secrets or that to reveal them all requires a consistency of skilful performance. Rather, the way that space is produced and consumed in *SMB1* makes many

secrets mutually exclusive. Mario's movement through the game world is (broadly) unidirectional. Running from left to right, new obstacles come into view and new space is produced. However, once that space scrolls by and disappears off the left edge of the screen, it is gone. *SMB1* supports no running back to re-explore spaces now out of the TV's frame. In *SMB1*, space is irretrievably consumed through the acts of running and jumping and may only be revisited, re-produced and replayed by dying and restarting the level afresh.

And there are multiple routes through courses and, in some cases at least, multiple exits that either conform to or confound the apparent spatial contiguity of the world - and even the course naming conventions. There are, for instance, three distinct ways to exit World 1-2 (four if we include the loss of all lives). The 'preferred' and most obviously signposted route sees Mario exit through a green pipe, grab the end of level Flagpole ready to tackle the numerically logical World 1-3. There is, however, a second, more obscure exit that demands counterintuitive play, lateral thinking and literal jumping outside the box. A gap in the brickwork above the second elevator means that a well-timed jump allows Mario to leap out of the frame. Landing on top of the ceiling (which becomes a floor) Mario occupies the same game/non-game space as the high score and timer interface elements. Continuing to run sees Mario pass the exit pipe (disrupting its spatial integrity in the process), along the top of the vertical wall of impermeable bricks putatively denoting the end of level, to arrive in the first of *SMB1*'s three 'Warp Zones'. Otherwise empty, the Warp Zones contain three pipes each of which offer non-linear access to later Worlds. In World 1-2, the pipes lead to Worlds 2-1, 3-1 or 4-1. By following these warps, the player can sidestep large parts of the game and gain access to stages they might not encounter (as the otherwise linear structure of the game relies on expertise and skill in execution in order to progress).

The third exit is altogether different, however, and relies on the exploitation of a glitch discovered by players rather than a specifically-designed route (see Mandelin n.d. and Newman 2017 for a fuller discussion). By positioning Mario in the right spot and jumping at a specific height, angle and speed, it is possible for the character to glide through the solid pipe and brickwork dropping majestically into the Warp Zone. By entering the Warp Zone in this altogether unintended manner, the pipe's destinations are altered. Where once the pipe on the left led to '4-1', it is now the conduit to World -1; a location that is both familiar and unfamiliar. As reported in Nintendo Power magazine by the mysterious 'Agent 826' (1988) just a few years after *SMB1*'s release, World -1 (aka the 'Minus World') is a course comprising a garbled,

incongruous mix of graphics, sound and gameplay with none of the subtlety or trademark design cues identifiable elsewhere in the game. Never explicitly designed, it is actually the product of a glitch that causes *SMB1*'s program to load garbled data and make calls to memory that, rather than a game-ending crash, procedurally generates a playable, albeit inescapable, course. Since the 1980s, World -1 has been an object of fascination and enquiry among *SMB1* fans and it remains the site of investigations deploying ever-more sophisticated game analysis tools. Despite its roots in code aberration and its discovery by fans, it plays an important role in game culture being referenced in other games (Figure 3 shows a still from a gameplay video demonstrating the Minus World glitch).

Figure 3. *Super Mario Bros.* (Nintendo, 1985) Monde 1-2
Game Inspector playing 'Minus World' gameplay movie

All of these routes, techniques, strategies and spaces are part of the experience and meaning of *SMB1*, yet many of them require considerable knowledge (or at least good fortune) to aid their discovery, all require skill in execution (with the Minus World 'wall ejection' glitch being fiendishly hard even then), and many are mutually exclusive requiring self-conscious replay (such as the routes through World 1-2). If our focus was only on the opening of the game and the design of World 1-1, the task of exhibition would be challenge enough. But, if we set ourselves the task of considering moments further 'into' games - such as World 1-2's multiple routes or the Minus World and its peculiar combination of glitches and code interactions, the task becomes exponentially more complex. Even if we could assume that World 1-2 could be reached and that 1-1's obstacle course and denizens did not wipe out the player's lives, it is

quite simply impossible to reveal the extent of the design work, experiential opportunity and code aberrations without multiple expert and informed playthroughs.

Inspecting videogames

Taking as our starting point the principles that videogames can be hard to play and complex (even deliberately obfuscatory) in their design - the extent of which very often cannot be revealed in a single playing - we were faced with two key options. The first was to fill our galleries with coin-operated arcade games from the 'golden age' of the 1970s and 1980s. Pac-Man, Space Invaders, Asteroids et al, offer one possible solution to our problems precisely because they were designed for use in a very similar context and with a surprisingly similar set of objectives. As Wade (2014) has noted in a detailed study of Pac-Man, for instance, these games present an economical interface (a single joystick augmented by perhaps one fire button, for instance), have a clarity of objective (stop the invaders reaching Earth), and represent the state and extent of their gameplay and interface on screen, on a single screen. This is not to say that these games are not hard or that they are not filled with secrets to be revealed (the killscreen in *Pac-Man*, for instance, see Newman 2016c) but rather that, in addition to the clarity and economy, their design typically incorporates an animated 'attract sequence' illustrating the core gameplay and is structured around a difficulty curve that allows even the novice player to make some initial progress without getting immediately annihilated and seeing the game over message. Additionally, as Swalwell (2017: 226) has observed, games such as Pac-Man 'have never become obscure' unlike contemporaries such as The Hobbitt, for instance, whose innovations in game design Stuckey (2014) has shown to be difficult to communicate to contemporary audiences decades on.

Partly because of their comparative accessibility and because they represent an important part of the history of videogaming whether measured in terms of design, interface or locations of play, there are, indeed, many coin-operated games currently on the floors of the NVA just as there are in exhibitions such as the Barbican's touring Game On, those at the Strong National Museum of Play's iCHEG, or in Berlin's Computerspielemuseum. However, as with these other exhibitions and projects, the NVA is not dedicated solely to showcasing and interpreting arcade games (despite its name!) As such, a key driver for the NVA from its outset was to explore the second option for interpretation and exhibition. As such, at least part of the project's intellectual and

physical resource has been dedicated to working with videogames that appear, prima facie, to be unaccommodating of gallery exhibition and display. This might arise from their difficulty and complexity, or because of the sheer amount of time required to reveal their extent even for those sufficiently skilful, knowledgeable and adept.

The Game Inspector is one response to that challenge and, given our previous research on the game and connections with Nintendo via the Ritsumeikan Center for Game Research in Kyoto, Super Mario Bros. - and World 1-2 in particular - became an early focal point.

Inspecting Mario

Initial prototyping focused on emulation and dealt with the issue of accessing later levels without traversing those preceding, through the provision of savestates. Savestates, are an affordance of emulation platforms which effectively allow a game to be 'paused' and recalled at a later date. This is a feature of the emulation platform and runs in parallel with any saving that the game being run might offer. *SMB1*, for instance, does not offer any game-saving functionality itself, but running the code under emulation, the action can be paused at absolutely any point. Triggering a savestate, selected from a menu with explanations and annotations, automatically transports the player to a specific location within the game world. As such, the traversal of space, the skill knowledge and competence required to progress to the particular point, can be sidestepped and the game navigated in a manner that subverts its spatial and ludic integrity. By working through the game and creating multiple savestates, a library of 'entry points' into the game can be created.

While this method offers many potential benefits over offering the game in its original form which, in the case of *SMB1*, would require each player to commence from World 1-1, it is useful only to a point. The savestate only alters the entry point to the level. Depositing the player in the vicinity of a secret Coin Palace hiding at the end of a green pipe or in front of the wall through which they must glitch to reach the Minus World, does not necessarily make these discoveries easier to come by. Certainly the ease with which the wall ejection glitch can be executed is utterly unaffected and becoming aware of the presence and location of the Warp Zones does little to assure the performance of a world record speedrun.

With the focus on accessibility, inclusivity and the exploration and revelation of these secrets rendering emulation-based strategies of limited use for our purposes, after some further

prototyping we arrived at a model inspired by the principles of gameplay preservation and that eschewed all playability in favour of the presentation, annotation and arrangement of video captures of gameplay (along with other audiovisual assets as we shall see). At its heart, the *SMB1* World 1-2 Game Inspector is a collection of captured gameplay performances that demonstrate the extent of the game's design, spatiality and ludic potential. By capturing and displaying performances of play rather than providing the opportunity to play, the Inspector allows normally mutually exclusive routes to be encountered and difficult manoeuvres to be carefully scrutinised. In essence, where emulation and save state strategies offers patrons/players the opportunity to play in the game's world, by assembling and presenting a malleable set of materials illustrating how the game is made and played, the Game Inspector allows them to play *with* it. And crucially, removing the urgency, threat and contingency of real-time playability, not only is the game more readily and leisurely explored, but also its facets and features are made accessible regardless of a priori knowledge or performance expertise.

Moreover, the decision to focus the exhibit around captured performances allows a conceptual and literal zooming in on moments of gameplay and design. For instance, as we alluded to above, a number of high performance play techniques in *SMB1* rely on the creative exploitation of the specifities of the game's collision detection routines. The 'walljump' technique is a case in point. By using this quirk of the game's engine, the player is able to perform seemingly impossible parkour-style double-jumps that utilise solid objects to give Mario extra boost. Explaining the execution of the technique, the TASvideos website notes that:

> To perform a walljump, three things are required:
>
> • Some horizontal speed towards the wall (facing right: X speed > 16, facing left: X speed < 240)
>
> • Mario's feet must hit the wall at a block boundary (every 16 pixels)
>
> • Some luck to make Mario go into the wall a little bit (at least for 1 pixel)
>
> (http://tasvideos.org/GameResources/NES/SuperMarioBros.html)

The technique is possible to execute both through emulation and via the original hardware and software and has become a standard part of the speedrunner's toolkit making accessible routes otherwise unavailable using regular jumps. Whether or not the walljump constitutes a glitch or is a discoverable affordance of the game system is a matter for speculation (in much the same way as the collision behaviours in *Sonic1* have been debated by fans, see Newman 2012b).

Nonetheless, it is a viable and exploitable tactic although, as the explanation above suggests, its execution requires more than a little skill combined with a modicum of good fortune. As the foundation for accessing high speed playthroughs as well as the Minus World, it is certainly a performance technique and code/design interaction of considerable importance in the *SMB1* lexicon and one central to an understanding of the game as played, yet it is a technique that is hard to experience at first hand and one ripe for demonstration.

Of course, demonstration is one thing but simply showing a recording of this gameplay technique does not automatically communicate any of the complexities of the interactions taking place. In order to comprehend what is at stake – what is at *play* – the audience requires an appreciation of the degree of control afforded to the player and, by extension, the degree of control that is removed as the wall jump is presented as a spectatable rather than playable interaction. The tension revealed here is that while the removal of agency sidesteps the need for expertise and high performance play, it is not meaningful in interpretative terms unless the observer is aware of the degree and contours of player agency and the contingency of the gameplay produced on that agency. Our solution to this issue involves augmenting and editing the raw gameplay thereby adding layers of interpretation potential to it and, counterintuitively perhaps, revealing the malleability of gameplay captured as a putatively linear stream.

By taking advantage of the language or grammar of video editing, we are able to deploy techniques such as freeze-framing, captioning, rewinding, pausing, zooming and panning to interrupt, interrogate and annotate gameplay. Moving through the sequences of performed play, into and out of the scene, backwards and forwards through the sequences defined through the interaction of player, code and interface. Figure 4 shows some key frames in a video sequence compiled to illustrate the design and exploitable characteristics of *SMB1*'s collision detection routines. The video begins with a full-speed play through of a jump that eagle-eyed viewers may note involves Mario apparently passing 'through' the normally deadly Piranha plant without injury. Rewinding the footage (complete with more-screen transport controls and backwards tape sound effect that underscore the fluidity of the captured material), the same jump is repeated at a slower speed with the process repeated (along with a slow zoom) until Mario's sprite is freeze-framed while clearly overlapping the Pirahna Plant. Overlaid atop this incongruous image drawn out of the 60 frames a second gameplay, captions and other on-screen diagramming explain how *SMB1*'s collision routine is based around the detection of sub-sprite 'hitboxes'. By capturing gameplay as video in this manner, and by making use of the editing

and editorial tools available in applications a such as Final Cut Pro or even iMovie, gameplay is far from a static stream and is recast as mutable and flexible. What is so exciting about this approach is how it opens up opportunities for showcasing a multiplicity of different facets of gameplay – from the most widely-utilised to the most esoteric – and to dig deep into an interrogation of the influence and contingency of the performance and agency that bring these techniques and tactics into existence.

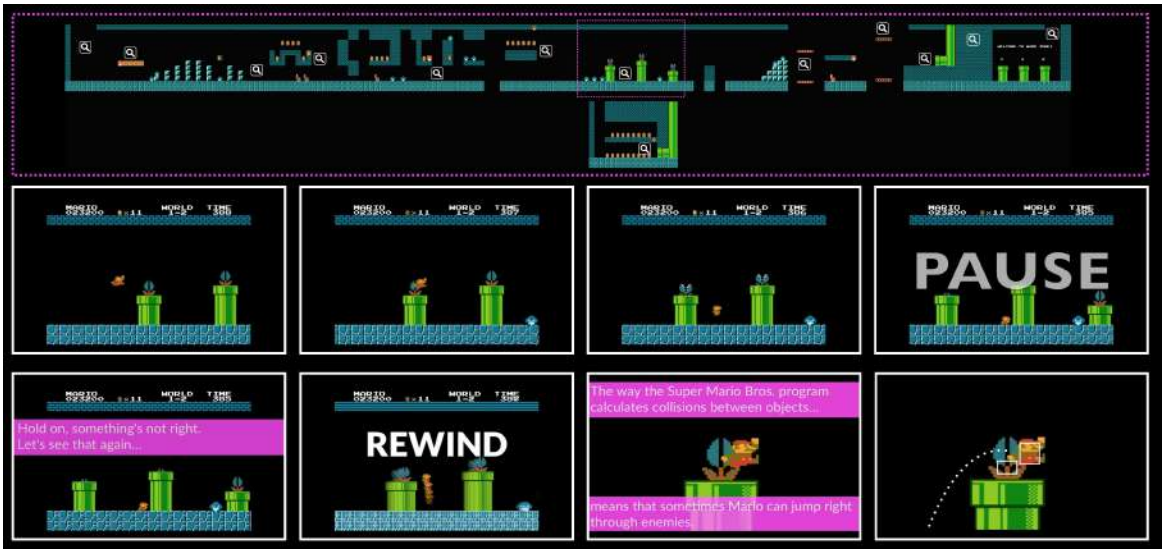

Figure 4. Key frames from a *SMB1* Game Inspector video illustrating collision detection and hitboxes

The desire to account for both large-scale contextual issues such as the design and flow of stages, along with the minutiae of collision detection routines at specific points in the world or the collection of a power-up, ultimately guided the decision to conceive of the Game Inspector project as a combination of game studies research and documentary filmmaking. And part of the result of this work is the creation of a bank of original assets that record these interactions, performance techniques and reveal the behaviours of enemies, the operation of the in-game engine, and presence of hidden spaces and objects.

At this stage, what I have described might sound as though the patron/user is required to navigate nothing more than a computer file system or jukebox in order to choose from a collection of curated, captured and edited video clips of gameplay. However, key to the Game Inspector, is the means by which these materials are presented. Crucially, these sequences of illustrative gameplay are not left decontextualised but rather are closely connected with the in-

game spaces in which they were performed (or, in some cases, the spaces which they generate). As Figures 1-3 illustrate, this connection and contextualisation is achieved by making *SMB1*'s in-game/level 'map' the central organisational and navigational apparatus.

The image at the top of Figure 1 shows a fully zoomed-out 'map' of *SMB1*'s World 1-2. It should be noted initially that this view of the level cannot be accessed from within the original game itself. Indeed, there is a no single asset that encompasses the entirety of the level's playable space. The image here is, in fact, a composite constructed by combining the screens' worth of data produced by moving through the game. As an aside, it is worth noting that early feedback on the *SMB1/Sonic1* Inspectors saw participants noting how valuable this navigable composite map was in allowing a different view and analysis of the game's space. For many, even those identifying as familiar with the Green Hill Zone from a player's perspective, this new view was refreshingly unfamiliar and revealed a vertical dimension to the levels not apparent from the game's level of zoom.

Over these maps are superimposed a layer of 'Game Inspector' icons located at specific points that relate to the materials that are called into view when they are triggered. This spatial connection is key in these examples and makes the linkage between the space produced and consumed in the game and the various moments of gameplay, design or performance techniques that were captured in our original documentary assets.

By focusing on the level as the unit of currency and by using the map to organise and arrange the various interpretative assets in a spatially coherent and context sensitive manner, the Game Inspector for World 1-2 creates a navigable space that facilitates the journey through the ways in which the game can be played. Importantly, by focusing on navigating through the space rather than requiring one to play through it, this journey is able to account for different playing styles, mutually exclusive routes through the space, is able to demonstrate difficult techniques reliant on both skill and luck, reveal hidden areas and illustrate the vagaries and exploitable characteristics of the game system's design and operation. With this principle in place and the conceptualisation of interpreting *SMB1* through these documentary methods, the scope for analysis and the demonstration of the game's malleability as material for play, or construction as an objective of deliberate (if sometimes flawed) design, is considerable.

In addition to the annotation of the game's composite map, a later (pre-NVA launch) revision of the Game Inspector expanded on the articulation of detail and context by more effectively

harnessing z-plane navigation. Here, by zooming out beyond the point where the level fills the entire screen, the user brings into view more contextual layers of information pertaining to the platform, advertising, marketing and reception of the game under scrutiny and its relation to other titles in a series or with which it competes or has been an influence, for instance. The further back the user zooms, the more far removed from the minute detail of gameplay or level design this information becomes. The design intention of this approach to the z-axis was to link it conceptually to the notion of 'leaning-in' to learn increasingly more detailed and esoteric information about the game. Figure 1 shows an in-development build of the *SMB1* Game Inspector with the 'zoom-out' cartridge/artwork layer visible.

Reflecting on the Game Inspector experiment

In some senses, the Game Inspector, certainly in its current form, is a comparatively simple proposition. It presents a navigable map overlaid with various audiovisual and textual assets, keyed to relevant locations in the game's world. This arrangement invites a consideration of the various ways in which the game is designed and played and reminds us of gameplay as an ongoing, co-creative dialogue between developer, player and source code (see Banks 2013). It is possible to build in HTML5 with audiovisual assets acquired through video capture of computer or console. Of course, there are myriad other materials that could be included that intercept controller inputs, record eye movements or heart rate (in much the manner we see deployed by streamers on Twitch, for instance) and these all feature on the NVA's development roadmap. Somewhere along that road, a version designed for VR might be finalised and deployed on the gallery floor that enables different kinds of interactions and a different kind of immersion in, and traversal of, a game's space. Nonetheless, regardless of the specifics of technical implementation, it remains a comparatively simple idea. Indeed, it actually emerged out of Powerpoint/Keynote presentation techniques that I and Iain Simons (NVA co-director) had developed over a decade of lectures and public talks.

At a conceptual level, it is my belief that the Game Inspector occupies - and produces - an interesting space that facilitates the revelation of meaningful and deep insights into design and performance practice without requiring, or offering, live gameplay. In this sense, it delivers on the NVA's objective for an accessible, inclusive means of exploring the complexities of games and both rewarding and encouraging inquisitiveness. As an expression of what I have broadly

termed 'gameplay preservation', it is founded on the assertion that play is too important to be only the outcome of the preservation or interpretative endeavour and must become the object and focus of that activity. Moreover, it proceeds from and hopefully contributes to the discussion of the importance of play in game (history) studies. And in response to the idea that 'games have to be played to be understood', the Game Inspector might seem like a project wholly predicated on rejecting such a premise. In a sense, the ethos of the Game Inspector could be read as one that positions play as a problematic, to be sidestepped. Surely, this will be provocative to some and perhaps the Game Inspector could be charged with a contradictory characterisation of play as breathing life into games while simultaneously acting as an impediment or barrier to understanding.

However, I would argue that the Game Inspector is part of a project founded on the recognition that games are understood and perhaps even constituted through their playing. Indeed, the Game Inspector is built around the principle of presenting the multiplicity of possible playings, each of which potentially remakes and reconfigures the game as a new entity. And, given that many of these potential playings are so contingent on skill, an intimate knowledge of technique, systems and glitches, and are often mutually exclusive in their execution, their collation into one explorable resource is of potential utility. By favouring the presentation of multiple playings, the Game Inspector is a reaction to the thesis that future playability might be able to reveal or recover the polysemy of games.

While the configurative and transformative function of play is at the heart of the Inspector, the project necessarily poses important questions as to *when* and *by whom* the game is to be played. Both *Sonic1* and *SMB1* remain playable at the time of writing albeit available as new purchases under emulation and with differing interfaces (via the 'Sega Forever' mobile platform and the NES Classic mini console, for instance). Indeed, as darbian's 2016 *SMB1* speedrun record attests, new techniques and exploits are still being discovered. As such, the pool of available ludic and interpretative resources continues to grow. However, if we cast our minds forward beyond next generations of hardware and software and into the next millennia, we might be less certain that these games and systems will remain in play in the same manner.

Viewed in this context, the Game Inspector is also a project that predicts the end of playability and seeks to create a complex citation matrix that draws on performances of play while they are available. Of course, this categorically is not to predict the end of *SMB1* but rather than the period of its 'life' in which it is playable, is a finite one that requires documentation, capture

and analysis. Anchored by the spatiality of the game/level and presenting audiovisual and textual material pointing to the breadth of critical readings and investigations of game scholars, designers and players alike, the early NVA Game Inspector models are a first step on this journey.

Next steps…

Of course, while there are a number of potential benefits brought by the Game Inspector both to exhibition, interpretation and citation practice, there are both practical and conceptual limitations also. Most obviously, as we noted above, the Inspector in its current form and as an expression of gameplay preservation privileges certain kinds of interactions and is based around a particular approach to game studies offering primacy to play and players, albeit in interaction with the object of design and programming. This is not to suggest that such materials could not be incorporated into such a citation project, although the term 'gameplay preservation' would reveal itself to be an increasingly inadequate descriptor in such circumstances.

Furthermore, game(play) preservation work inevitably raises what remain currently complex questions of Intellectual Property whose contours and potential solutions vary between territories (see Maier 2015). The complexity of the issues even causes problems for rights holders themselves as Cifaldi (2016) notes in relation to questions over the provenance of Nintendo's Virtual Console *SMB1* ROM. Indeed, as Lastowka (2013) notes, there has even been some discussion (e.g. Burke 2013) that gameplay performances might be copyrightable though Lastowka suggests unlikely at present given the precedent of sporting performances. Nonetheless, the uncertainty outlined by EFGAMP (2015) and others certainly makes the case for working with developers who own their own IP and the NVA's collaboration with boneloaf on the *Gang Beasts* Inspector has provided fruitful access to development materials and even custom builds of the game showcasing animation and collision detection routines, for instance. All of this reminds us of the difficulty of a one-size-fits-all approach and the necessity of tailoring the interpretative model to the game(s) in question.

Development continues on these questions and while the focus of this article has been on the design of interpretative exhibits for 2D games, for 3D titles, including those from the Traveller's Tales/WB Games LEGO series for instance, a different approach to the Inspector was adopted. Eschewing the map for organisation, and more closely resembling DVD-style

'Director's Commentaries', here annotations and notes remain overlaid on sequences of captured gameplay which are (unlike the Director's Commentary) paused, freeze-framed, rewound and zoomed as part of the interpretative process.

Indeed, in April 2017, we opened a new gallery exhibit celebrating the work of The Oliver Twins and their 'Dizzy' series of games that have been available on a host of computing platforms from the 1980s to the present.

For the exhibition, the Olivers had given us full access to their physical and digital archive including all of the carefully documented and archived design documentation for each of the released games (and some unreleased prototypes). The majority of this documentation was meticulously hand drawn on squared paper. Maps of each game dedicated one paper square to a screen with every puzzle, solution and pathway notated (and occasionally showing the evidence of reworking as pencil lines were erased and redrawn). Where we had fashioned an overview map of *SMB1*'s World 1-2 digital space by stitching together in-game graphics, here we had access to the original analogue planning sheets. In this regard, the Dizzy Game Inspector differed a little from our earlier exhibits in focusing more explicitly on design process as well as gameplay and on the translation of paper to pixels.

The Dizzy Map Inspector, as shown in Figure 5, is based around a large scale reproduction of the hand drawn map for *Dizzy III* (the original map is displayed behind Perspex next to the Inspector). Each scene/screen encountered and experienced in the game is literally mapped out with detail of the environment and puzzles clearly visible and a demonstrable sense of how these screens fit together to create the world. Importantly, as with the *SMB1* Inspector, this is not a view one ever normally gets unless, as many players did, one mapped one's progress through the game to chart these interconnections (and simultaneously reverse engineering the Olivers' original design process).

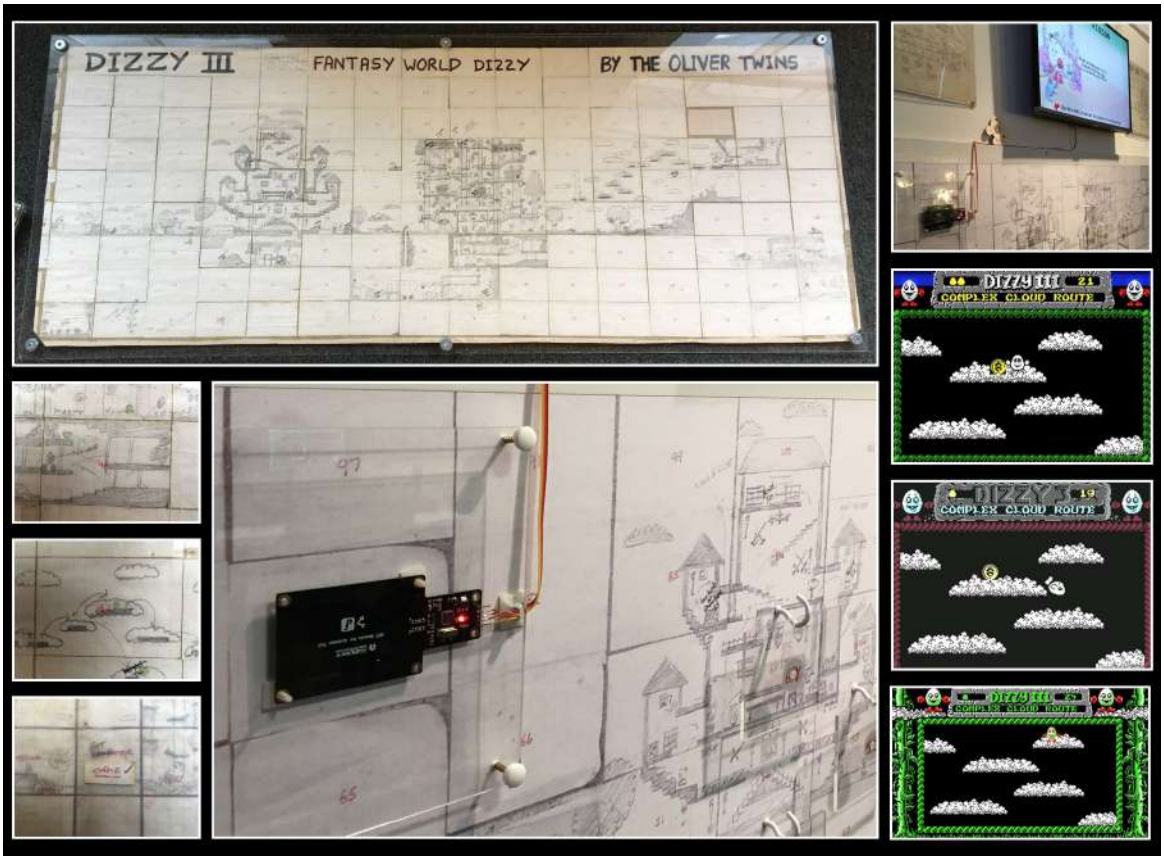

Figure 5. The 'Dizzy Inspector'. Top & left : The Oliver twins' hand-drawn map. Center bottom: The enlarged map with NFC reader and hooks for removable NFC-tagged map square. Top right: Tapping the tagged squares triggers video clips showing the gameplay at the specific location in-game. Lower right: Three screenshots of the same sequence (Spectrum, C64, Amstrad CPC)

To really explore that process of translation from planning document to gameplay, the Dizzy Inspector makes use of NFC technology to allow visitors to 'remove' sections of the large map, scan them on the bespoke reader, and reveal video captured gameplay from that point in the game. By capturing footage of the final game at play and triggering it with an NFC-tagged facsimile of the Olivers' squared paper, visitors can see exactly how those meticulously planned out stages and puzzles appear as pixels. And how they can be tackled in the final game(s) as gameplay is drawn from different (con)versions of the *Dizzy III* title including Amstrad CPC, Commodore 64, ZX Spectrum and PC.

As such, the exhibit draws attention to and invites comparison of the multiple instances of the 'same game' (see Stuckey 2015; Newman 2012b). Moreover, the exhibit also makes it possible to identify the places where the final game deviates from the plan—sometimes this is about

tweaking in playtesting, and sometimes it reveals the interaction between design, code and game engine. Falling down two paper squares worth of well shaft, for instance, does not require two separate screens' worth of data. One digital well shaft fallen down twice does the same job and saves precious memory and storage space.

Moving beyond the 2D maps, plans and screens of the Dizzy series, and thinking more speculatively, drawing on the investigative practices and tools of game modders offers new opportunities to inspect 3D games. By deploying game hacking tools that place the in-game camera under the control of the player and permit passing through ordinarily solid objects (sometimes known as ‘noclipping’ modes where implemented as ‘cheats’ in first person shooters), 3D environments and models may be more freely explored than under the containment of normal gameplay conditions. Subverting the game’s limitations of player movement and viewpoint, such tools make malleable material out of otherwise restrictive environments allowing the exploration of space and the revelation of underpinning systemic logic of the game beneath or behind the narrative or ludic performance. Such techniques and tools potentially offer some of the same opportunities for organisation and interpretation found in the *SMB1* Game Inspector’s 2D map. By allowing views and viewpoints literally impossible by other means and, crucially, by dissociating camera and player/character movement, they reconfigure the game world as a navigable arena. Shesez’s ‘Boundary Breaking’ YouTube series showcases these clipping and camera manipulation techniques for the purposes of environment exploration and the analysis of character/enemy spawning routines, for instance (https://www.youtube.com/user/PencakeAndWuffle/). The use of such tools expands the available vocabulary for preservation practitioners and, for instance, suggests the use of captured ‘noclip/magic camera' explorations both as the foundation for annotation or analysis and as part of the suite of available interpretative materials.

Finally, while gameplay preservation and the Inspectors are founded on the principle that games are not static ludic entities but rather continue to be explored, unravelled and remade (both re-released for new platforms and reconfigured through exploratory play), there is a danger of a fallacious location of this malleability as an historical act. Of course, the ongoing playability of *SMB1* whether under emulation or through the availability of new ports, ensures that the story of the game continues finding new contexts and meanings along the way. Accounting for this longevity and the lives and afterlives of videogames is key to the interpretative project of gameplay preservation which, as a documentary project, must be as attentive to the meanings of

SMB1 in 2085 as in 1985. In this way, I would suggest that the Game Inspector in 2085 should attend to - and capture - the responses, reactions and performances of players encountering *SMB1* as preserved under emulation.

Regardless of the specifities of their current implementations or the directions they might be taken by the NVA teams or others developing this work further, among the key contributions made by the Game Inspectors is the making concrete of an approach to game interpretation, exhibition and citation based around gameplay capture anchored to the spatiality of the gameworld. The approach draws its net wide in its search for interpretative and illustrative resources and negotiates a number of apparently contradictory and challenging conceptions of play. Ultimately, the Game Inspector simultaneously recognises the transformative, creative and configurative potency of play as well as its time-limited nature in relation to specific instances of 'unstable' games/texts. Most crucially, that very same play is both constitutive of 'the game' in multitudinous forms, and can be the barrier to access and understanding. Of course, substituting playability for recorded play presents the challenge of articulating the contours and effect of the performing player's agency. In the current implementations of the Game Inspector, the translation of interactive gameplay into video allows the use of editing techniques that actually serve to render stream malleable and fluid. Perhaps the NVA's (2015) *Jump! Special Exhibition Guide* goes a little too far in stating that 'we've played the games so that you don't have to' but the idea that one could never play the game in all the ways that it supports remains a compelling one and continues to drive forward our research and practice.

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